WHAT IS CLAIMED IS:

1. A time-division-multiplexed light signal channel extraction method that separates the multiplexed signals into as many as N channels and extracts the channel numbers in order to provide the demultiplexed signals to the output ports of which port numbers match with the channel numbers, comprising:

a demultiplexing step of demultiplexing the multiplexed signals into N channels and providing the demultiplexed signals to as many as N separate ports;

an extraction step of extracting the channel number of at least one channel in the N channels corresponding to said N separate ports;

a switching step of switching the N channels to the output ports of which port numbers uniquely match with the numbers of the N channels based on the relationship between the number of the one channel identified in the extraction step and the output port number corresponding to said one channel number; and

an output step of providing the signals of said switched N channels to the output ports of which output port numbers match with the channel numbers.

2. A time-division-multiplexed light signal channel extraction method that separates the multiplexed signals into as many as N channels and extracts the

channel numbers in order to provide the demultiplexed signals to the output ports of which port numbers match with the channel numbers, comprising:

a demultiplexing step of demultiplexing the multiplexed signals into N channels and providing the demultiplexed signals to as many as N separate ports;

an extraction step of extracting the channel number of at least one channel in the N channels corresponding to said N separate ports;

a control step of controlling the signals of said N channels provided to the separate ports so that the N channel numbers uniquely match with the output port numbers based on the relationship between the number of the one channel identified in the extraction step and the output port number corresponding to said one channel number; and

an output step of providing the signals of said switched N channels to the output ports of which output port numbers match with the channel numbers.

3. A time-division-multiplexed light signal channel extraction method that separates the multiplexed signals into as many as N channels and extracts the channel numbers in order to provide the demultiplexed signals to the output ports of which port numbers match with the channel numbers, comprising:

a demultiplexing step of demultiplexing the

irregular-intervals time-division-multiplexed light signals, of which channel intervals on the time axis are not regular, into N channels and providing the demultiplexed signals to as many as N separate ports of the same intervals as those of the channels, wherein, when the numbers of the N channels match with the numbers of the output ports, the signals are provided to all the N separate ports;

a control step of monitoring the signal output to the output ports and controlling the signals of said N channels provided to the separate ports so that all the N separate ports receive signal output; and

an output step of providing the signals of said switched N channels to the output ports of which output port numbers match with the channel numbers.

4. The method as set forth in claim 3, wherein, when the i-th channel is adjacent to the (i+1)-th channel, the N-th channel is adjacent to the first channel, the bit rate is Nfo(bit/s), the pulse width is τ_{send}sec, the channel intervals meet the relations $\tau_{send} \leq 1/(Nf_o)$ and $\Delta t_1+\Delta t_2+...+\Delta t_{N-1}+\Delta t_N = 1/f_o$, said irregular-intervals time-division-multiplexed light signals meet the relation $\Delta t_i(i=1, 2,..., N) \neq \Delta t_j(j=1, 2,..., N)(j\neq i)$.

5. The method as set forth in claim 4, wherein the channel intervals meet the relations:

$\Delta t_i (i=1, 2, \ldots, N) \neq \Delta t_j (j=i+1 \text{ or } j=i-1)$;

$\Delta t_{N+1} = \Delta t_1$; and

$\Delta t_{-1} = \Delta t_N$.

6. A time-division-multiplexed light signal channel extraction apparatus that separates the multiplexed signals into as many as N channels and extracts the channel numbers in order to provide the demultiplexed signals to the output ports of which port numbers match with the channel numbers, comprising:

an optical time-division-demultiplexing means for demultiplexing the multiplexed signals into N channels and providing the demultiplexed signals to as many as N separate ports;

a channel extraction means that is connected to the N separate ports and extracts the channel number of at least one channel in the N channels corresponding to said N separate ports;

a channel switching means for switching the N channels to the output ports of which port numbers uniquely match with the numbers of the N channels based on the relationship between the number of the one channel identified by the channel extraction means and the output port number corresponding to said one channel number; and

an output means that has as many as N output ports and provides the signals of said switched N

channels to the output ports of which output port numbers match with the channel numbers.

7. A time-division-multiplexed light signal channel extraction apparatus that separates the multiplexed signals into as many as N channels and extracts the channel numbers in order to provide the demultiplexed signals to the output ports of which port numbers match with the channel numbers, comprising:

an optical time-division-demultiplexing means for demultiplexing the multiplexed signals into N channels and providing the demultiplexed signals to as many as N separate ports;

a channel extraction means that is connected to the N separate ports and extracts the channel number of at least one channel in the N channels corresponding to said N separate ports;

a channel control means for controlling the signals of said N channels provided to the separate ports so that the N channel numbers uniquely match with the output port numbers based on the relationship between the number of the one channel identified by the channel extraction means and the output port number corresponding to said one channel number; and

an output means that has as many as N output ports and provides the signals of said switched N channels to the output ports of which output port

numbers match with the channel numbers.

8. A time-division-multiplexed light signal channel extraction apparatus that separates the multiplexed signals into as many as N channels and extracts the channel numbers in order to provide the demultiplexed signals to the output ports of which port numbers match with the channel numbers, comprising:

a optical time-division-demultiplexing means for demultiplexing the irregular-intervals time-division-multiplexed light signals, of which channel intervals on the time axis are not regular, into N channels and providing the demultiplexed signals to as many as N separate ports of the same intervals as those of the channels, wherein, when the numbers of the N channels match with the numbers of the output ports, the signals are provided to all the N separate ports;

a channel control means for monitoring the signal output to the output ports and controlling the signals of said N channels provided to the separate ports so that all the N separate ports receive signal output; and

an output means that has as many as N output ports and provides the signals of said switched N channels to the output ports of which output port numbers match with the channel numbers.

9. The apparatus as set forth in any one of claims 6-8; wherein said optical time-division-demultiplexing means comprising:

a means for coupling the multiplexed signals and chirp light pulses; and

a cross-correlating means for providing a cross-correlation signal when the multiplexed signal overlaps the chirp light pulse and converting the sequence of the N channels for multiplexed signals on the time axis into the unique sequence of channels on the wavelength axis to provide the demultiplexed signals to the N separate channels.

10. The apparatus as set forth in claim 9, wherein said cross-correlating means provides a cross-correlation signal by using one of the four wave mixing using a semiconductor amplifier, cross phase modulation using optical fiber, cross absorption modulation using an electric field absorption type optical amplifier and quasi-phase matching in secondary nonlinear optical material.

11. The apparatus as set forth in any one of claims 6-8; wherein said optical time-division-demultiplexing means comprising:

a coupling means that provides different delays to at least either the multiplexed signals separated

into N channels or the gate light pulses separated into N channels so that the signals and pulses overlap at different timing in the individual channels; and

as many as N cross-correlating means for providing a cross-correlation signal when the multiplexed signal overlaps the chirp light pulse.

12. The apparatus as set forth in claim 11, wherein said cross-correlating means provides a cross-correlation signal by using one of the four wave mixing using a semiconductor amplifier, cross phase modulation using optical fiber, cross absorption modulation using an electric field absorption type optical amplifier and quasi-phase matching in secondary nonlinear optical material.

13. The apparatus as set forth in claim 8, wherein, when the i-th channel is adjacent to the (i+1)-th channel, the N-th channel is adjacent to the first channel, the bit rate is Nfo(bit/s), the pulse width is τ_{send}sec, the channel intervals meet the relations $\tau_{send} \leq 1/(Nf_o)$ and $\Delta t_1+\Delta t_2+...+\Delta t_{N-1}+\Delta t_N = 1/f_o$, said irregular-intervals time-division-multiplexed light signals meet the relation $\Delta t_i(i=1, 2,..., N) \neq \Delta t_j(j=1, 2,..., N)(j\neq i)$.

14. The apparatus as set forth in claim 13, wherein

the channel intervals meet the relations:

$\Delta t_i (i=1, 2, \ldots, N) \neq \Delta t_j (j=i+1 \text{ or } j=i-1)$;

$\Delta t_{N+1} = \Delta t_1$; and

$\Delta t_{-1} = \Delta t_N$.